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EG&G ISC **ISC-ES-06 82 14.00 99 (January 2009)**

Preparing Activity: EG&G ISC-ES (NEW)

EG&G ISC GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2009
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FIBERGLASS REINFORCED PLASTIC (FRP) PIPE AND TUBE RAILINGS

01/09

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SECTION 06 82 14.00 99

FIBERGLASS REINFORCED PLASTIC (FRP) PIPE AND TUBE RAILINGS
01/09

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NOTE: This guide specification covers fiberglass reinforced plastic (FRP)pipe and tube railings, customarily manufactured to meet specific requirements in building construction and fabricated FRP items, which are not a part of the structural FRP components or framework.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification at ISC-ES.
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NOTE: Units of work normally included in this section should be FRP items which require specific fabrication to meet the desired project requirements.
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NOTE: Include in drawings a complete design indicating the character of the work to be performed and showing the following:

1.Location and details of each fabricated FRP pipe and tube railings components showing all dimensions, shapes, and sizes of members, connections, and the relation of items to other building components.

2. All sizes and dimensions.

3. Special fastenings, attachments or anchoring, including anchorage devices embedded in other construction,including but not limited to, precast

concrete wall panels, precast concrete structural members, precast concrete roof decking, brick and block masonry, and precast stone work; anchorage devices to structural steel framework, including, but not limited to, steel bar grating, steel floor plates, and structural steel roof or floor decking.

4. Location and special details of expansion joint covers.

5. Connection details, other than manufacturer's standard for pipe and tube railings.

8. Locate and detail removable sections of handrails.

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PART 1 GENERAL

1.1 SUMMARY

This Section includes, but is not limited to, new fiberglass reinforced plastic (FRP) pipe and tube railing/guards, mounting systems and accessories.

1.2 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of the Project Specifications and are a component to the requirements for the work contained in this Section.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A10.3	(2006) SAFETY REQUIREMENTS FOR POWDER-ACTUATED FASTENING SYSTEMS-AMERICAN NATIONAL STANDARD FOR CONTRUCTION AND DEMOLITION OPERATIONS

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE/SEI 7-05	(2006) Minimum Design Loads for Buildings and Other Structures, Including Supplement No. 1

ASME INTERNATIONAL (ASME)

ASME B18.2.1	(1996; Addenda A 1999; Errata 2003; R 2005) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(1987; R 2005) Standard for Square and Hex Nuts
ASME B18.21.1	(1999; R 2005) Lock Washers (Inch Series)
ASME B18.21.2M	(1999; R 2005) Lock Washers (Metric Series)
ASME B18.22.1	(1965; R 2008) Plain Washers
ASME B18.6.2	(1998; R 2005) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws: Inch Series
ASME B18.6.3	(2003; R 2008) Machine Screws and Machine Screw Nuts

ASTM INTERNATIONAL (ASTM)

ASTM A 307	(2007b) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 687	(1993) Standard Specification for High-Strength Nonheaded Steel Bolts and Studs
ASTM C 1107/C 1107M	(2008) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D 1148	(1995, R 2001) Standard Test Method for Rubber Deterioration-Heat and Ultraviolet Light Discoloration of Light Colored Surfaces
ASTM D 2344/D 2344M	(2000; R 2006) Standard Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates
ASTM D 430	(2006) Standard Test Method for Rubber Deterioration-Dynamic Fatigue
ASTM D 638	(2008) Standard Test Method for Tensile Properties of Plastics
ASTM D 696	(2008) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30

	degrees C With a Vitreous Silica Dilatometer
ASTM D 790	(2007e1) Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM E 488	(1996; R 2003) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
ASTM E 84	(2008a) Standard Test Method for Surface Burning Characteristics of Building Materials

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2006; Errata 2006; Errata 2007; Supplement 2007; Errata 2007) International Building Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2008) Life Safety Code, 2006 Edition

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.23	Guarding Floor and Wall Openings and Holes
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.502	Fall Protection Systems Criteria and Practices

1.3 PERFORMANCE REQUIREMENTS

1.3.1 Structural Performance

Provide a pipe and tube railing system capable of withstanding the effects of gravity loads in accordance with ASCE/SEI 7-05 [and [International Building Code, ICC IBC] [the state of [_____] Building Code]] with the following loads and stresses within limits and under conditions indicated:

a. Handrails:

(1) Uniform load of 50 lbf/ft. applied in any direction.
(2) Concentrated load of 200 lbf applied in any direction.
(3) Uniform and concentrated loads need not be assumed to act concurrently.

b. Top Rails of Guards:

(1) Uniform load of 50 lbf/ft. applied in any direction.
(2) Concentrated load of 200 lbf applied in any direction.
(3) Uniform and concentrated loads need not be assumed to act concurrently.

c. Infill of Guards:

(1) Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
(2) Uniform load of 25 lbf/sq.ft. applied horizontally.
(3) Infill load and other loads need not be assumed to act concurrently.

1.4 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.
****

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualifications of Manufacturer

Qualifications of Engineer of Record

Manufacturer's sample warranty

SD-02 Shop Drawings

Include plans, elevations, sections, details, and attachments to other work.

For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

Submit templates, erection and installation drawings indicating thickness, type, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the building construction.

SD-03 Product Data

Manufacturer's catalog data is to include two copies of manufacturer's specifications, load tables, dimension diagrams, and anchor details for the following items:

FRP Pipe and Tube
Railings/Guards
Anchorage Materials
Adhesives
Resins
Hardeners

SD-06 Test Reports

Ultraviolet Test Reports
Thermal Expansion Test Reports
Flame Spread Test Reports

SD-07 Certificates

Manufacturer's Certification by the state of [_____] Product Approval

Proof of Certification from a minimum of two quality assurance programs for its facilities or products (UL, DNV, ABS, USCG, AARR)

SD-08 Manufacturer's Instructions

Manufacturer's recommendations for shipping, handling, erection procedures, and care and maintenance upon completion of installation.

SD-09 Manufacturer's Field Reports

Manufacturer's Certification of Installation

SD-11 Closeout Submittals

Manufacturer's Warranty

1.5 QUALITY ASSURANCE

1.5.1 Qualifications of Manufacturer

Submit Qualifications of Manufacturer documentation certifying that the Fiberglass Reinforced Plastic (FRP) manufacturer has a minimum of [10][_____] years experience in manufacturing FRP products.

[Submit documentation proving of a minimum of at least 5 previous,

separate, similar installations within the last [5] [10] [__] years.]

[Submit Proof of Certification from a minimum of two quality assurance programs for its facilities or products (UL, DNV, ABS, USCG, AARR).]

[Submit Manufacturer's Certification by the state of [_____] Product Approval.]

Provide Manufacturer's sample warranty for all FRP products against defects in material and workmanship for a minimum of [5] [__] years. Provide evidence of manufacturer's ISO 9001-2000 standard certification.

1.5.2 Qualifications of Engineer of Record

[Submit Qualifications of Engineer of Record documentation that the Engineer of Record is currently licensed within the jurisdiction of the project.]

[Submit documentation that the Engineer of Record is approved, authorized, and currently licensed by the state of [_____], and has a minimum of five years experience as an approved Engineer for manufacturers of similar ladder systems. Require the Engineer of Record to supply the name and location of five projects of similar size and scope for which he has provided engineering calculations using the manufacturer's products submitted for this project within the previous three [_____] years. Provide certified and signed calculations prepared by Engineer for:]

ASCE/SEI 7-05,in accordance with International Building Code.

1.6 PRODUCT DELIVERY AND STORAGE

Deliver all manufactured materials in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturers, clearly marked and identified relative to the complete system. Provide all adhesives, resins and their catalysts and hardeners in clearly marked or noted crates or boxes to facilitate their safe movement to a dry indoor storage facility with a constant temperature range between 70 and 85 degrees Fahrenheit until they are required.

Handle all materials to prevent abrasion, cracking, chipping, twisting, or other deformations and other types of damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

Provide items within this section from manufacturers having a minimum of [5] [10] [__] years experience in the design and manufacture of similar products and systems.

2.2 PRODUCT REQUIREMENTS

All posts and rails are to be FRP structural shapes manufactured by the pultrusion process. Compose structural shapes of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements in accordance with ASCE/SEI 7-05, 29 CFR 1910.23, NFPA 101, and dimensions specified.

Fiberglass reinforcements to be a combination of continuous roving,

continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.

Provide resins, with appropriate hardeners, of isophthalic polyester with chemical formulation necessary for corrosion resistance, strength and other physical properties as required.

All finished surfaces of FRP items, including FRP pipe and tube, railings/guards, anchorage materials, and fabrications are to be smooth, resin-rich, free of voids and without dry spots, cracks, and un-reinforced areas. Completely cover all glass fibers with resin to protect against their exposure due to wear or weathering.

All pultruded structural shapes to be further protected from ultraviolet (UV) attack with:

a. Integral UV inhibitors within the resin
b. Synthetic surfacing veil to help produce a resin rich surface
c. UV resistant coating for outdoor exposures.

All FRP products to have a flame spread rating of 25 or less as per ASTM E 84 Tunnel Test. Submit [_____] copies of Flame Spread Test Reports to the Contracting Officer.

All rails, posts, and kick plates are to be integrally pigmented yellow. Submit [_____] copies of Ultraviolet Test Reports for FRP material, similar to the requirements of ASTM D 1148 for rubber deteioration, and ASTM D 430, to the Contracting Officer. Also submit testing data relating to Thermal Expansion Test Reports.

Set structural shapes in the guardrail system to meet minimum longitudinal mechanical properties as follows:

a.	Tensile Strength:	ASTM D 638	30,000 psi
b.	Tensile Modulus:	ASTM D 638	2,500,000 psi
c.	Flexural Strength:	ASTM D 790	30,000 psi
d.	Flexural Modulus:	ASTM D 790	1,800,000 psi
e.	Flexural Modulus-Full Section:		2,800,000 psi
f.	Short Beam Shear:	ASTM D 2344/D 2344M	4,500 psi
g.	Shear Modulus-Transverse:		450,000 psi
h.	Coefficient of Thermal Expansion	ASTM D 696	.000008 in/in/F
i.	Flame Spread:	ASTM E 84	25 or less

2.3 MISCELLANEOUS MATERIALS

2.3.1 Fasteners

Provide Type 316 stainless-steel concealed fasteners, unless unavoidable or standard for railings indicated.

2.3.2 Anchors

Provide [cast-in-place] [epoxy] [mechanical] anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the design load imposed when installed in unit masonry and equal to four times the design load imposed when installed in concrete, as determined by testing per ASTM E 488.

2.3.3 Grout And Anchoring Cement

Factory-packaged, non-shrink, nonmetallic grout complying with ASTM C 1107/C 1107M; or water-resistant, non-shrink anchoring cement; recommended by manufacturer for exterior use. All other adhesives are to conform to the manufacturer's recommendations and instructions.

2.3.4 Component Connections

2.3.4.1 Lag Screws and Bolts

Provide lag screws and bolts conforming to ASME B18.2.1, of the type and grade best suited for the purpose.

2.3.4.2 Toggle Bolts

Provide toggle bolts conforming to ASME B18.2.1.

2.3.4.3 Bolts, Nuts, Studs and Rivets

Provide bolts, nuts, studs, and rivets conforming to ASME B18.2.2 and ASTM A 687 or ASTM A 307.

2.3.4.4 Powder Driven Fasteners

Follow safety provisions of ANSI A10.3.

2.3.4.5 Screws

Provide screws conforming to ASME B18.2.1, ASME B18.6.2, and ASME B18.6.3.

2.3.4.6 Washers

Provide plain washers conforming to ASME B18.22.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers conforming to ASME B18.21.2M and ASME B18.21.1.

2.4 SHOP FABRICATION

Perform fabrication of the handrail post/rail connection such that the rails are unbroken and continuous through the post without the use of packs or splices. Install the bottom rail through the post at a prepared hole made to fit the outside dimensions of the rail, and the top rail fit into a machined, u-shaped pocket formed into top of the post such that the rail is located at the center of the post. Radius all exposed corners to eliminate sharp edges. Join the rails to the post through a combination of bonding and riveting. No sharp, protruding edges are to remain after assembly of the handrail. Spacing of the posts are not to exceed 6'-0". Attach post base according to the construction contract drawings. Reinforce post base to a height of 8-1/2". All field and shop fabricated cuts are to be coated with a vinyl ester resin to provide maximum corrosion resistance.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items in accordance with 29 CFR 1910.23 and 29 CFR 1926 at locations indicated, according to manufacturer's instructions. Verify all

measurements and take all field measurements necessary before fabrication. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, to be included. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation.

a. Set posts plumb within a tolerance of 1/16 inch in three (3) feet.

b. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in twelve (12) feet.

3.2 WORKMANSHIP

FRP work to be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching to produce clean true lines and surfaces. Exposed surfaces of work in place to have a smooth finish. Where tight fits are required, joints to be milled. Corner joints to be coped or mitered, well formed, and in true alignment. Accurately set work to established lines and elevations and securely fastened in place. Installation to be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

3.2.1 Performance Requirements

Installed pipe and tube railing system is to fully comply with 29 CFR 1926.502, 29 CFR 1910.23 and support a concentrated load of 200 lbf applied in any direction as required by the [International Building Code] [state of [_____] Building Code].

3.2.2 Installation

Assemble and install ladder system and all components in strict accordance with the manufacturer's assembly documentation. Seal all cut or drilled surfaces per manufacturer's instructions. Provide adequate ventilation during all drilling, cutting, and resin application procedures. Submit [_____] signed copies of Manufacturer's Certification of Installation.

3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous FRP items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts and screws. Conceal fastenings where practicable.

3.4 WARRANTY

Submit [_____] signed copies of the Manufacturer's Warranty.

-- End of Section --